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Yang et al.

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(54) **LIGHT BULB**

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F21V 19/00	(2006.01)

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(58) **Field of Classification Search**

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See application file for complete search history.

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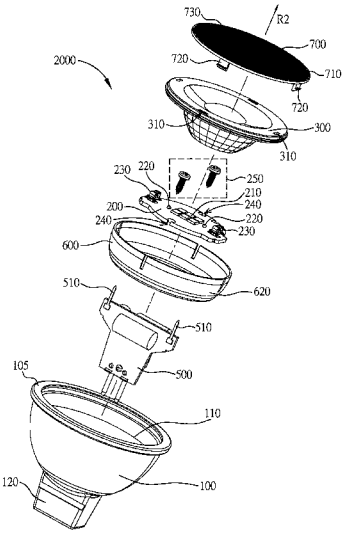
(57) **ABSTRACT**

A light bulb includes a housing, an illuminating component, a driving circuit board, a light transmitting component and a lens. The housing has a circumferential opening and a cavity chamber therein. The illuminating component is disposed within the cavity chamber. The driving circuit board is disposed inside the cavity chamber. The driving circuit board is also electrically coupled to the illuminating component. In addition, the driving circuit board drives the illuminating component while being powered up. The light transmitting component is disposed within the cavity chamber and affixed to the illuminating component. The light transmitting component includes a plurality of transmitting microstructures on its surface that uniformly distribute lights emitted from the illuminating component along an axial direction of the light bulb. The lens is disposed within the cavity chamber. The lens also focuses the uniformly distributed lights on a predetermined range along the axial direction of the light bulb.

13 Claims, 6 Drawing Sheets



(51) **Int. Cl.**

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F21Y 113/17	(2016.01)
F21Y 115/10	(2016.01)

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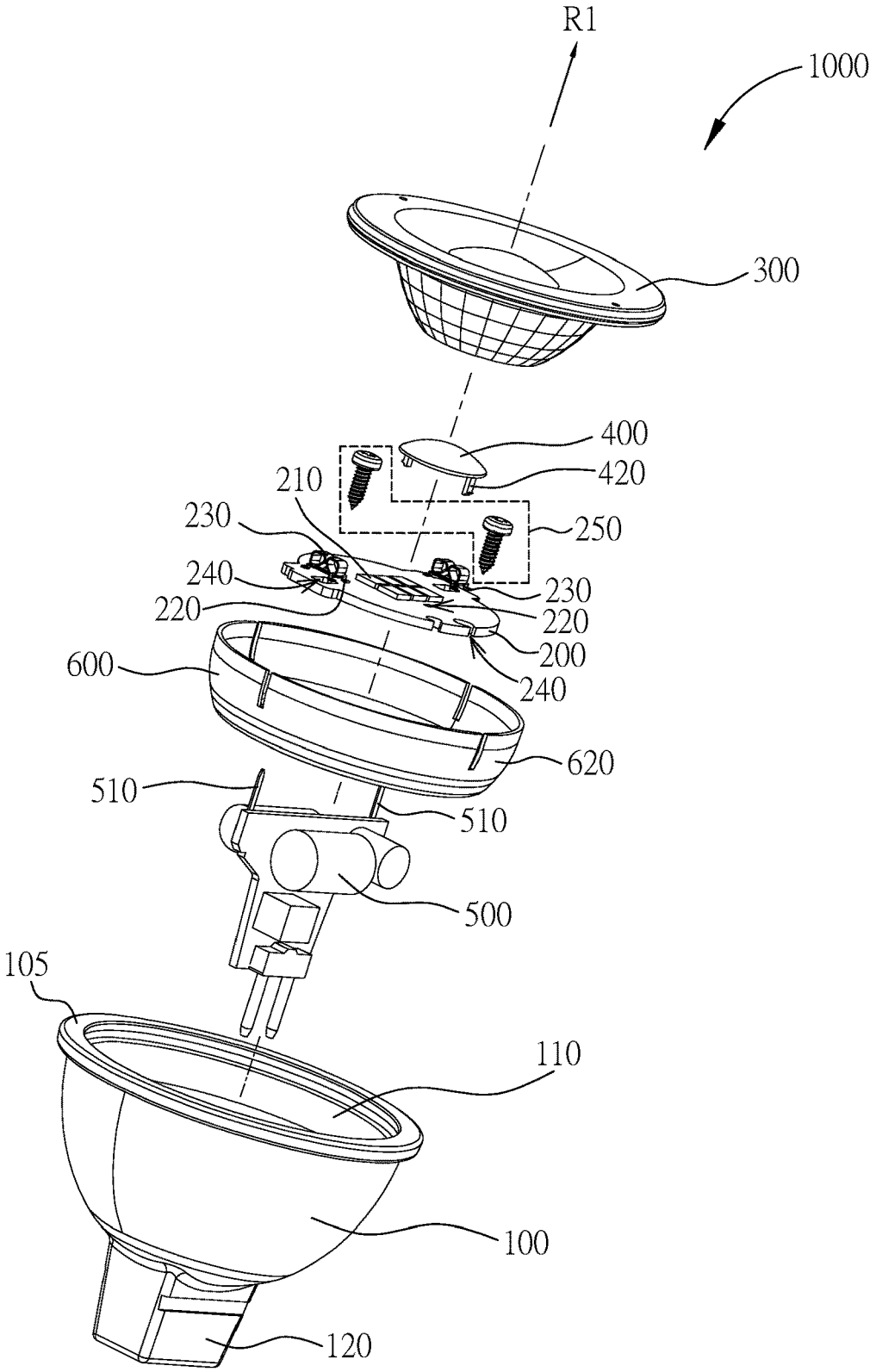

R1
1000
300
400
420
210
230
250
240
230
220
220
200
600
240
620
510
510
500
105
110
100
120

FIG. 1

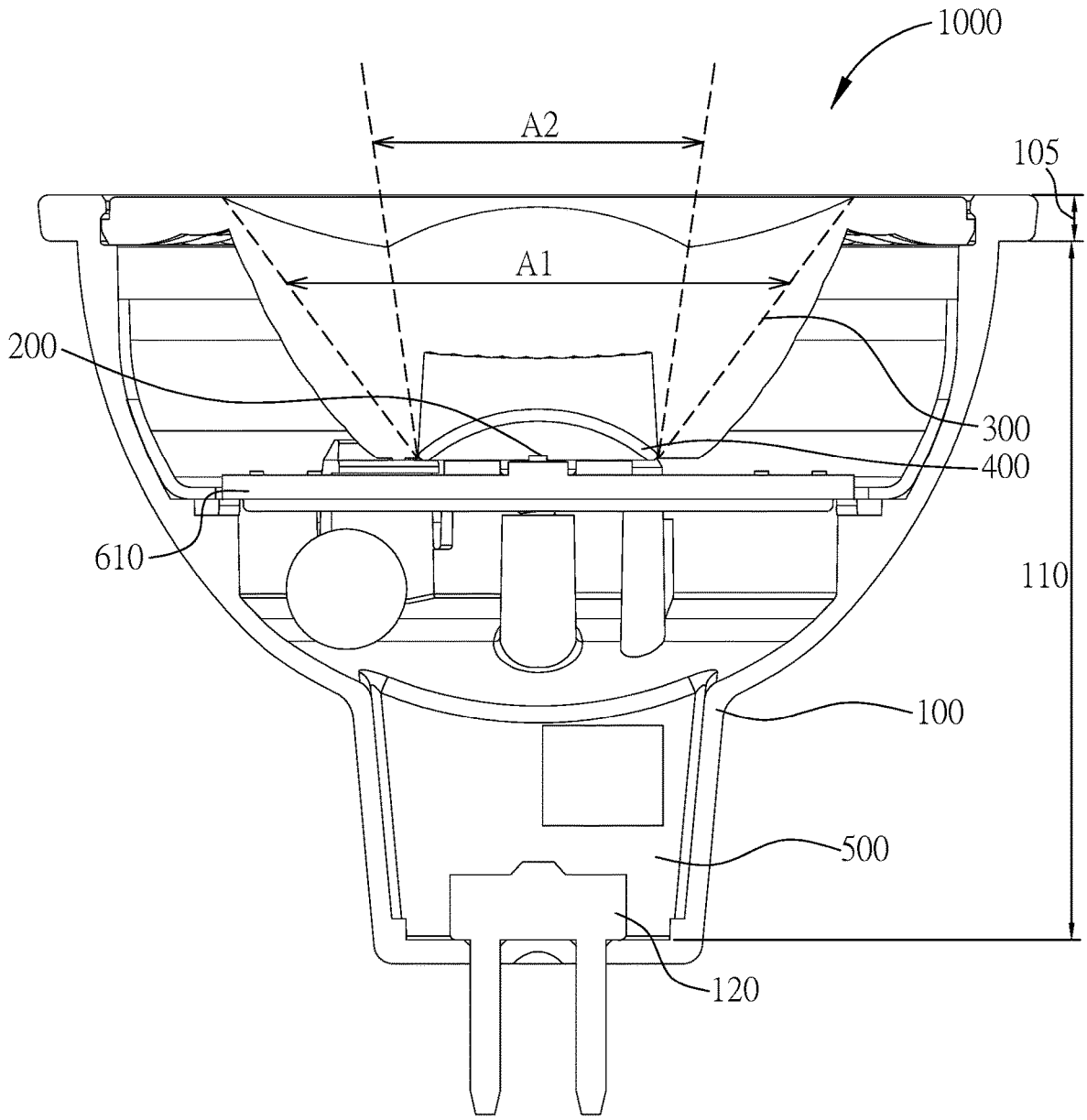
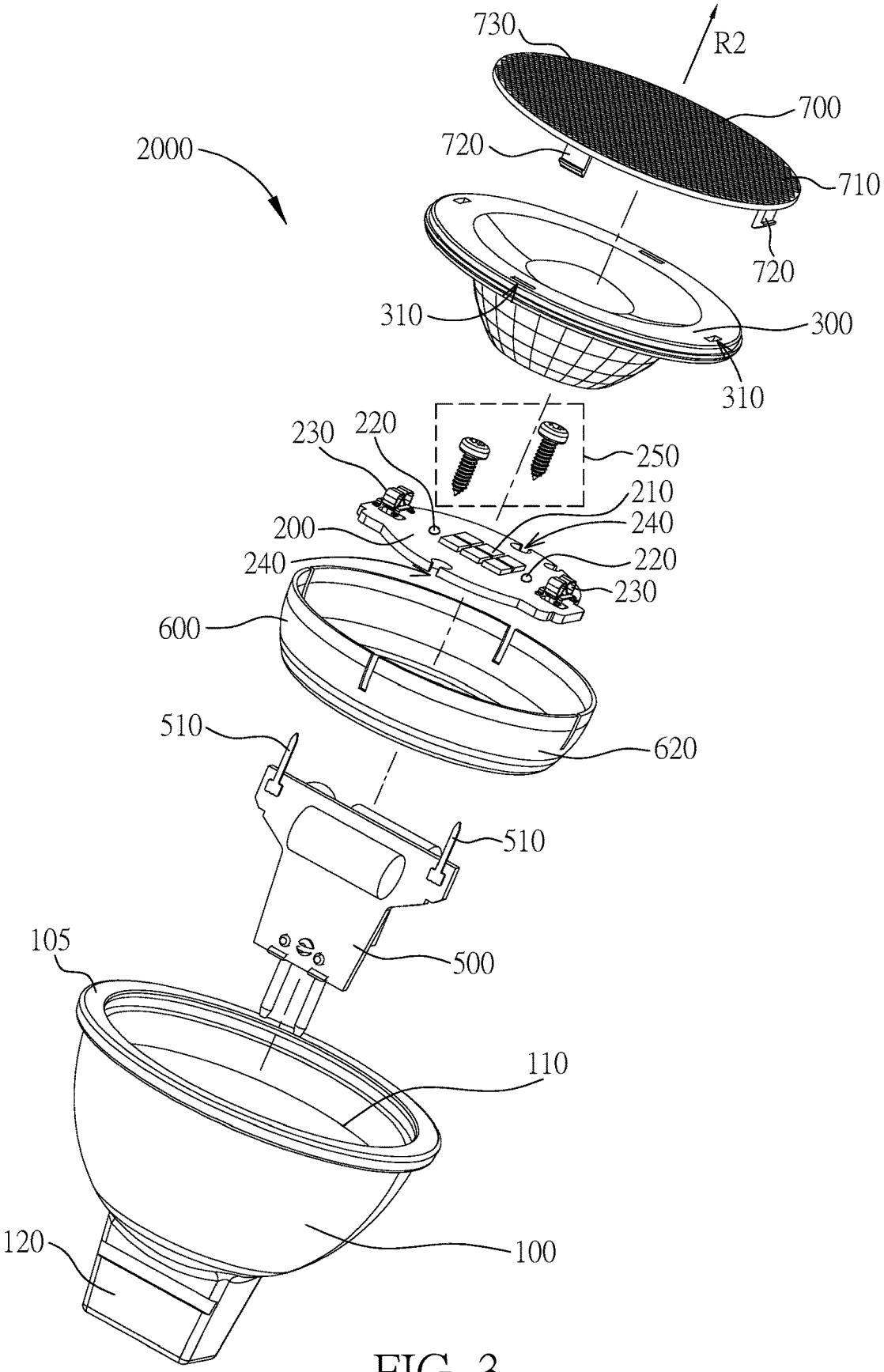


FIG. 2


730
R2
700
2000
720
710
720
310
300
310
230
220
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210
200
240
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220
230
600
510
620
510
105
500
110
120
100

FIG. 3

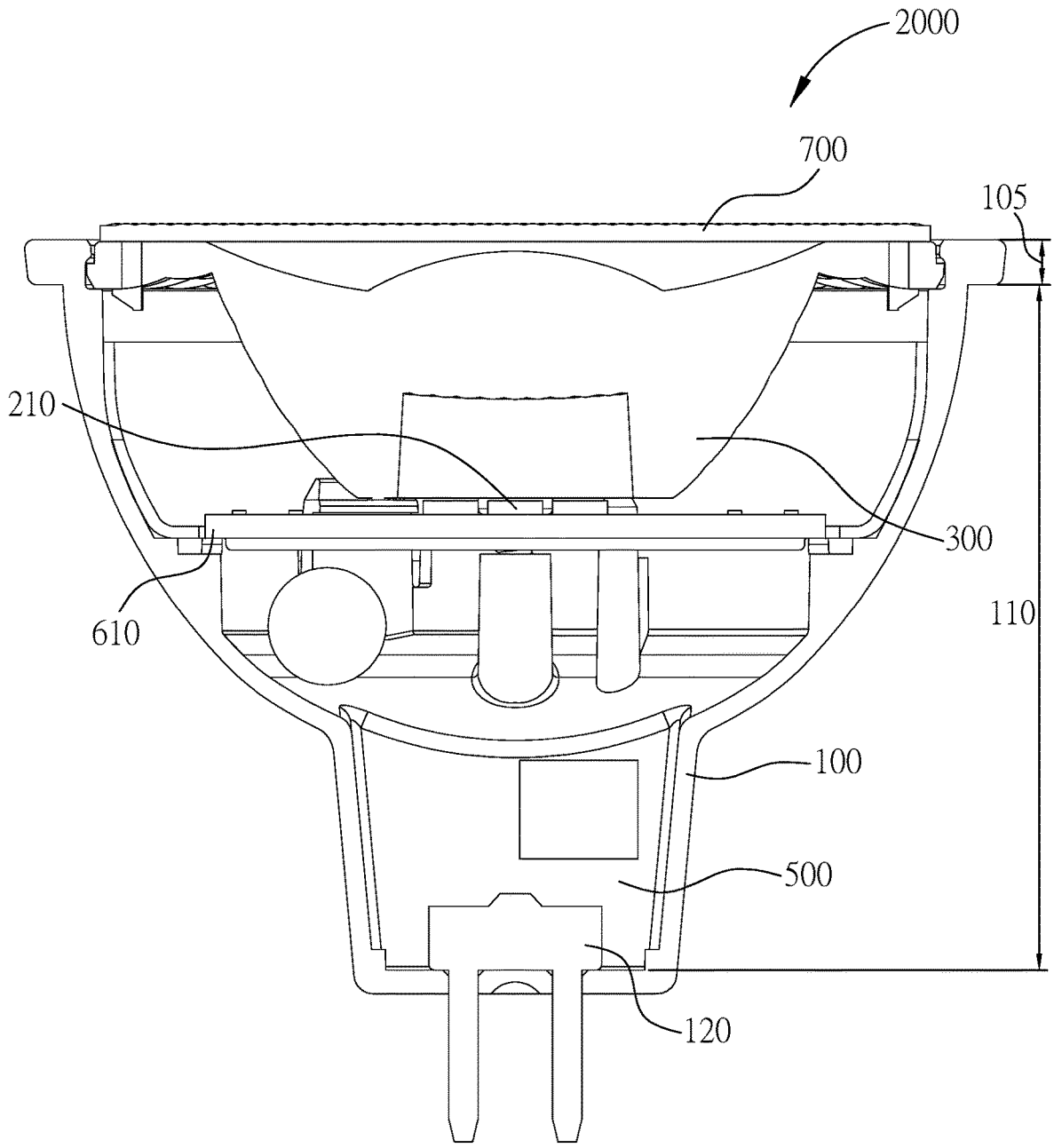

FIG. 4

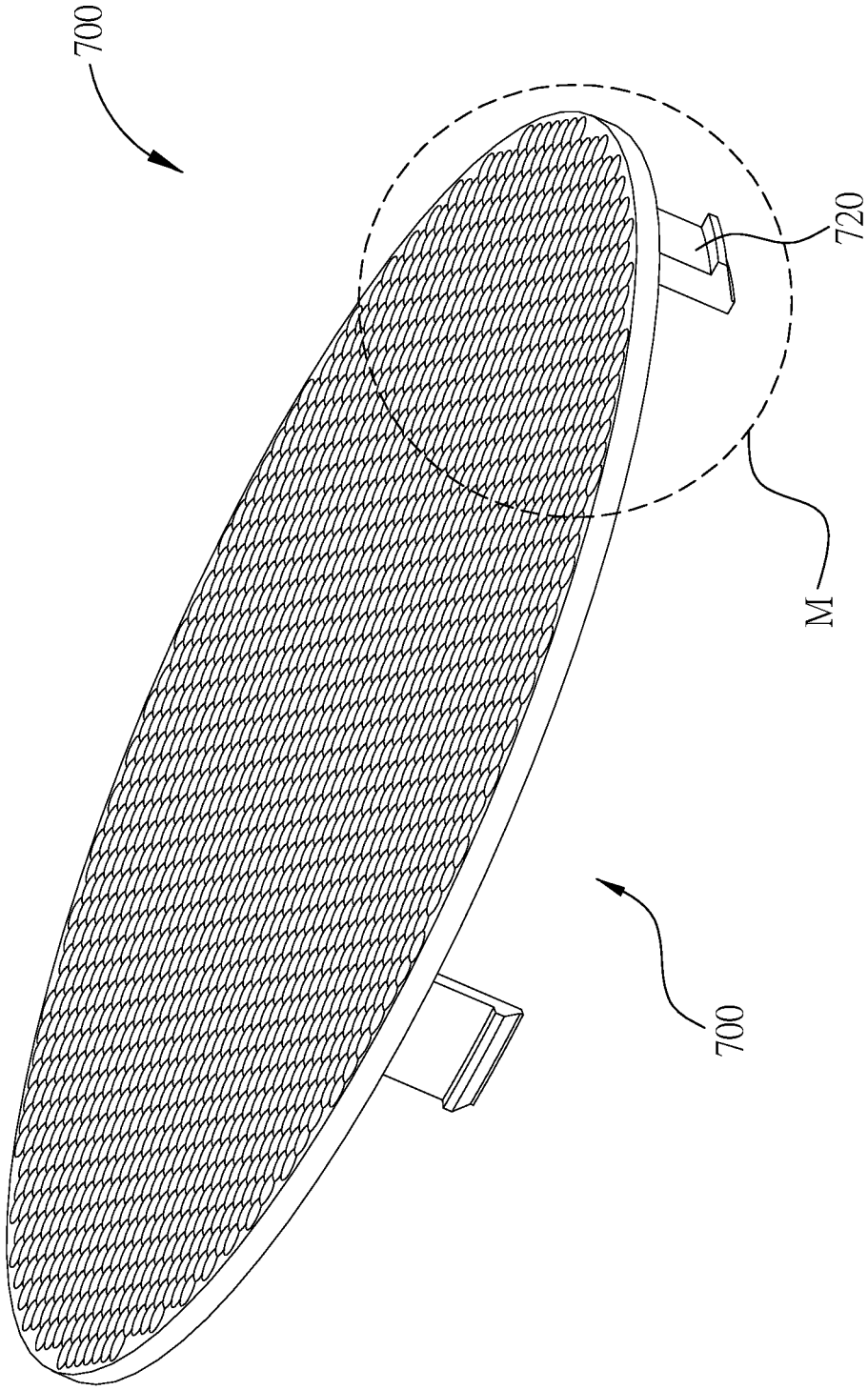

FIG. 5

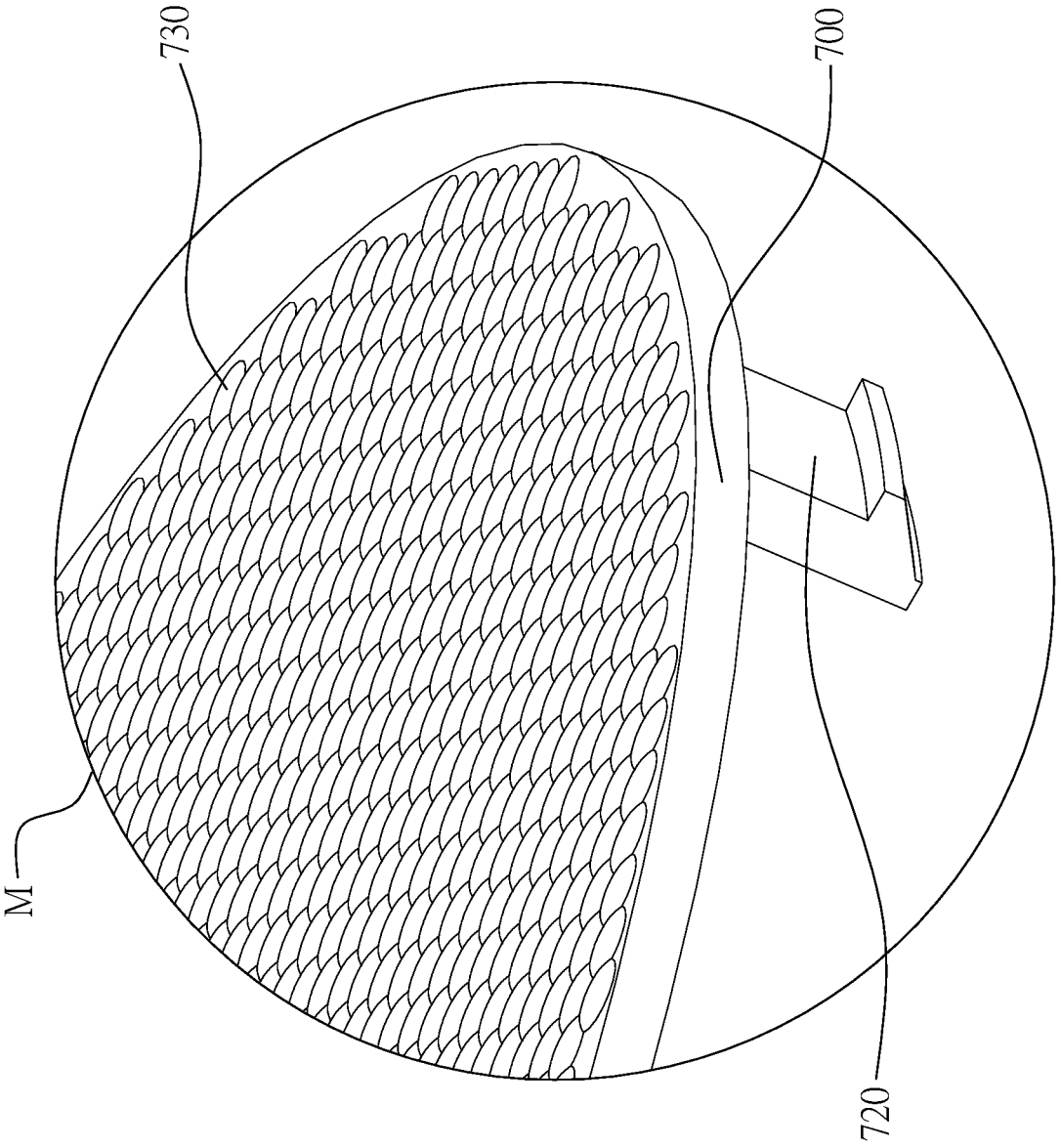

FIG. 6

LIGHT BULB

BACKGROUND

1. Field of the Invention

The present invention relates to a light bulb, and particularly relates to a light bulb capable of uniformly distributing its luminance.

2. Description of the Prior Art

A conventional light bulb, e.g. a light-emitting diode (LED) light bulb, is used for providing sufficient luminance. However, the conventional light bulb is also requested to acquire more additional functions, such as providing dynamically adjustable luminance and/or color temperature. Such additional functions are difficult to achieve because the conventional light bulbs have less flexibility in design of adjustable luminance and/or color temperature. More specifically, switching of different color temperature requires different types of light bulbs and an appropriate arrangement of these light bulbs. Such arrangement of different types of light bulbs is inevitably biased. In this way, generated spotlights must have a dim shape and/or non-uniform color graduals.

SUMMARY OF INVENTION

For neutralizing the conventional light bulb's defect of uniformly illumination, the present invention discloses certain types of light bulbs.

In a first embodiment, the present invention discloses a light bulb, which includes a housing, an illuminating component, a driving circuit board, a light transmitting component and a lens. The housing has a circumferential opening and a cavity chamber therein. The illuminating component is disposed within the cavity chamber. The driving circuit board is disposed inside the cavity chamber. The driving circuit board is also electrically coupled to the illuminating component. In addition, the driving circuit board drives the illuminating component while being powered up. The light transmitting component is disposed within the cavity chamber and affixed to the illuminating component. The light transmitting component includes a plurality of transmitting microstructures on its surface that uniformly distribute lights emitted from the illuminating component along an axial direction of the light bulb. The lens is disposed within the cavity chamber. The lens also focuses the uniformly distributed lights on a predetermined range along the axial direction of the light bulb.

In one example, the illuminating component includes a plurality of light emitting diodes that emit at least two different color temperatures.

In one example, the light transmitting component is arc-shaped.

In one example, the light transmitting component further includes a first engaging element that faces the illuminating component. The illuminating component further includes a second engaging element that faces the light transmitting component. The first engaging element is detachably engaged with the second engaging element, such that the light emitting component engages with the illuminating component.

In one example, the light transmitting component includes an opal glass diffusing plate.

In one example, the disclosed light bulb further includes a bulb base, which is disposed within the cavity chamber for supporting the illuminating component.

In one example, the bulb base includes a circumferential base plate and a sidewall. The circumferential base plate is disposed between the illuminating component and the driving circuit board. The circumferential base plate matches the circumferential opening of the housing, such that the base plate is capable of fitting the cavity chamber. The sidewall is coupled to the circumferential base plate. The sidewall also surrounds the illuminating component. The illuminating component and the driving circuit board are disposed in opposite sides of the base plate.

In one example, the illuminating component further includes a power socket. The base plate further includes a driving through hole. The driving circuit board further includes a conductive connector. The conductive connector passes through the driving through hole and reaches the power socket for detachably engaging both the illuminating component and the driving circuit board to the base plate. The driving circuit board further drives the illuminating component via an electrical connection between the conductive connector of the driving circuit board and the power socket of the illuminating component.

In one example, the light bulb further includes a screw. The illuminating component further includes a screw through hole that allows the screw to screw through. The housing further includes a screw hole within the cavity chamber for receiving the screw. The screw screws through the screw through hole and reaches the screw hole for detachably engaging the illuminating component to the housing.

In one example, the illuminating component includes a surface mounted light emitting diode (SMD LED) module.

In one example, the housing further includes a socket. The socket is disposed at the surface of the housing and electrically coupled to the driving circuit board. The socket also powers up the driving circuit board while being electrically coupled to an external power source.

In a second embodiment, the present invention further discloses a light bulb that includes a housing, an illuminating component, a driving circuit board, a lens and a light transmitting component. The housing has a circumferential opening and a cavity chamber therein. The illuminating component is disposed within the cavity chamber. The driving circuit board is disposed inside the cavity chamber. The driving circuit board is also electrically coupled to the illuminating component. In addition, the driving circuit board drives the illuminating component while being powered up. The lens is disposed within the cavity chamber. The lens also focuses lights emitted by the illuminating component on a predetermined range along an axial direction of the light bulb. The light transmitting component is disposed at the circumferential opening of the housing to cover the lens. The light transmitting component includes a plurality of light transmitting microstructures on its surface that uniformly distribute the focused lights from the lens along the axial direction of the light bulb.

In one example, the light transmitting component includes a light guide plate.

In one example, each of the plurality of light emitting microstructures is hexagon-shaped.

In one example, the light transmitting component is circular-shaped.

In one example, the illuminating component includes a plurality of light emitting diodes, e.g., a plurality of arranged LEDs **210**, which emit at least two different color temperatures.

In one example, the light transmitting component further includes a first engaging element that faces the lens. The lens further includes a second engaging element that faces the light transmitting component. The first engaging element is detachably engaged with the second engaging element, such that the light emitting component engages with the lens.

In one example, the light transmitting component includes an opal glass diffusing plate.

In one example, the light bulb further includes a bulb base, which is disposed within the cavity chamber for supporting the illuminating component.

In one example, the bulb base includes a circumferential base plate and a sidewall. The circumferential base plate is disposed between the illuminating component and the driving circuit board. The circumferential base plate matches the circumferential opening of the housing such that the base plate is capable of fitting the cavity chamber. The sidewall is coupled to the circumferential base plate. The sidewall also surrounds the illuminating component. The illuminating component and the driving circuit board are disposed in opposite sides of the base plate.

In one example, the illuminating component further includes a power socket. The base plate further includes a driving through hole. The driving circuit board further includes a conductive connector. The conductive connector passes through the first through hole and reaches the power socket for detachably engaging both the illuminating component and the driving circuit board to the base plate. The driving circuit board further drives the illuminating component via an electrical connection between the conductive connector of the driving circuit board and the power socket of the illuminating component.

In one example, the light bulb further includes a screw. The illuminating component further includes a screw through hole that allows the screw to screw through. The housing further includes a screw hole within the cavity chamber for receiving the screw. The screw screws through the screw through hole and to reach the screw hole for detachably engaging the illuminating component to the housing.

In one example, the illuminating component includes a surface mounted light emitting diode (SMD LED) module.

In one example, the housing further includes a socket. The socket is disposed at the surface of the housing. The socket is also electrically coupled to the driving circuit board. In addition, the socket powers up the driving circuit board while being electrically coupled to an external power source.

These and other objectives of the present invention will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the preferred embodiment that is illustrated in the various figures and drawings.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** illustrates a split view of a light bulb according to a first embodiment of the present invention.

FIG. **2** illustrates a lateral perspective view of the light bulb shown in FIG. **1**.

FIG. **3** illustrates a split view of a light bulb according to the second embodiment of the present invention.

FIG. **4** illustrates a lateral perspective view of the light bulb **2000** shown in FIG. **3**.

FIG. **5** illustrates the light transmitting component shown in FIG. **3** in detail according to one example.

FIG. **6** illustrates part of the light transmitting component shown in FIG. **5** in more details.

DETAILED DESCRIPTION

As mentioned, the present invention discloses certain light bulbs for neutralizing biased illuminance and capable of providing various types of color temperatures in a more uniform manner. Note that the disclosed light bulb may include LED light bulbs or other types of light bulbs.

FIG. **1** illustrates a split view of a light bulb **1000** according to a first embodiment of the present invention. Also, FIG. **2** illustrates a lateral perspective view of the light bulb **1000** shown in FIG. **1**.

The light bulb **1000** includes at least a housing **100**, an illuminating component **200**, a driving circuit board **500**, a light transmitting component **400** and a lens **300**.

The housing **100** has a circumferential opening **105** and a cavity chamber **110**, which is located inside the opening **105**. The illuminating component **200** is disposed within the cavity chamber **110**.

The driving circuit board **500** is disposed inside the cavity chamber **105**. Also, the driving circuit board **500** is electrically coupled to the illuminating component **200**, for example, at a bottom side of the illuminating component **200**, such that the driving circuit board **500** is capable of driving the illuminating component **200** while the driving circuit board **500** is powered up via an external power source.

The light transmitting component **400** is disposed within the cavity chamber **110**. Also, the light transmitting component **400** is affixed to the illuminating component **200**, for example, at a top side of the illuminating component **200**. In some examples, the light transmitting component **400** includes multiple transmitting microstructures on its surface. Also, the transmitting microstructures are used for uniformly distributing lights emitted from the illuminating component **200** along an axial direction R**1** of the light bulb **1000**, for example, by diffraction, refraction, or scattering of lights. With the aid of the transmitting microstructures, lights emitted from the light transmitting component **400** can be better focused on a certain area below the opening **105**, for example, an area A**1** shown in FIG. **2**.

The lens **300** is disposed within the cavity chamber **110**. Similar as the light transmitting component **400**, the lens **300** again focuses the uniformly distributed lights emitted from the light transmitting component **400** on a predetermined range A**2** along the axial direction R**1** of the light bulb **1000**. Because of the uniformly distributed lights from the light transmitting component **400**, light spots emitted from the lens **300** can form a clearer contour. More particularly, when multiple light bulbs **1000** are well arranged in a designed manner, the generated light spots can be more easily controlled to generate desired luminance on desired regions without dim contours.

In one example, the illuminating component **200** includes multiple light emitting diodes (LEDs) that emit at least two different color temperatures. In this way, for the purpose of presenting a specific color temperature, multiple light bulbs **1000** can be arranged by design to generate the desired color temperature without dim contours. Also, in another example, the illuminating component **200** is a surface mounted light emitting diode (SMD LED) module, which has a broader angle and range of illuminating, such that the light bulb **1000** may emit a broader range of illuminance.

In one example, the light transmitting component **400** is arc-shaped. Such that the light transmitting component **400** is capable of better focusing lights from the illuminating component **200** on a desired region, for example, the region A**1** shown in FIG. **2**.

In one example, the light transmitting component **400** and the illuminating component **200** are specifically designed to better engage with each other in a detachable manner. For example, the light transmitting component **400** further includes at least one first engaging element **420** that faces the illuminating component **200**. Also, the illuminating component **200** further includes at least one second engaging element **220** that faces the light transmitting component **400** and respectively corresponds to each of the at least one first engaging element **420**. The light transmitting component **400** can be detachably engaged with the illuminating component **200** by detachably engaging the at least one first engaging element **420** with the at least one second engaging element **210**.

In one example, the light transmitting component **400** may be implemented using an opal glass diffusing plate for efficiently distributing lights from the illuminating component **200** in a uniform manner.

In one example, the light bulb **1000** may further include a bulb base **600**, which is disposed within the cavity chamber **110** for better supporting the illuminating component **200**. More specifically, the bulb base **600** may include a circumferential base plate **610** and a sidewall **620**. The circumferential base plate **610** is sandwiched between the illuminating component **200** and the driving circuit board **500**. For example, as shown in FIGS. **1-2**, the illuminating component **200** is disposed at an upper side of the circumferential base plate **610**, whereas the driving circuit board **500** is disposed at a lower side of the circumferential base plate **610**. For gaining support from the housing **100**, the circumferential base plate **610** matches the circumferential opening **105** of the housing **100** in shape and size, such that the base plate **600** is capable of fitting the cavity chamber **110**. Moreover, the sidewall **620** is coupled to the circumferential base plate **610**. The sidewall **620** also surrounds the illuminating component **200** for protection. For driving the illuminating component **200**, the driving circuit board **500** is electrically coupled to the illuminating component **200** for powering up and control when the driving circuit board **500** is charged using an external power source. Specifically, in one example, the illuminating component **200** further includes at least one power socket **230** for powering up the illuminating component **200**. The base plate **610** may further include at least one driving through hole (not illustrated) that respectively corresponds to the at least one power socket **230**. And the driving circuit board **500** may further include at least one conductive connector **510**, which is capable of passing through the at least one driving through hole and reaching the at least one power socket **230** in turn for detachably engaging both the illuminating component **200** and the driving circuit board **500** to the base plate **610**. On top of that, the housing **100** may further include a socket **120** at its surface, as shown in FIG. **1**. The socket **120** is also electrically coupled to the driving circuit board **500** within the cavity chamber **110**. Such that when the socket **120** is electrically coupled to an external power source, the socket **120** can charge the driving circuit board **500**. In turn, the driving circuit board **500** is capable of driving the illuminating component **200** via an electrical connection between the conductive connector **510** of the driving circuit board **500** and the at least one power socket **230** of the illuminating component **200**.

In one example, the illuminating component **200** may be further screwed to the housing **100** for better engagement, for example, with the aid of at least one screw **250** of the light bulb **1000**. The illuminating component **200** further includes at least one screw through hole **240** that allows the at least one screw **250** to screw through. The housing **100** further includes a screw hole (not shown) within the cavity chamber **110** for receiving the at least one screw **250**. In this way, the at least one screw **250** screws through the screw through hole **240** and reaches the screw hole for detachably engaging the illuminating component **200** to the housing **1000**. According to a second embodiment, the present invention further discloses a light bulb **2000**. The light bulb **2000** shares most features as those of the light bulb **1000**, except for the position of the light transmitting component **400**. More specifically, the light bulb **2000** removes the light transmitting component **400** between the lens **300** and the illuminating component **200**.

Instead, the light bulb **2000** utilizes another transmitting component **700** and disposes it to cover the lens **300**.

FIG. **3** illustrates a split view of the light bulb **2000** according to the second embodiment of the present invention. Also, FIG. **4** illustrates a lateral perspective view of the light bulb **2000** shown in FIG. **3**.

As mentioned above, since the light bulb **2000** shares most features and/or dispositions as those of the light bulb **1000**, repeated features and dispositions are skipped for brevity.

The light bulb **2000** does not include the light transmitting component **400**, instead, it includes another light transmitting component **700** disposed at the circumferential opening **105** of the housing **100** to cover the lens **300**. Also, the light transmitting component **700** includes multiple light transmitting microstructures **730** on its surface. The multiple light transmitting microstructures **730** uniformly distribute focused lights from the lens **300** along an axial direction R**2** of the light bulb **2000**.

In one example, the light transmitting component **700** is implemented using a circular-shaped plate, for example, a circular light guide plate for fitting an upper flat surface of the light transmitting component **700**. The light guide plate, i.e., the light transmitting component **700**, the is capable of better focusing lights from the lens **300** than a curve-surfaced lens.

FIG. **5** illustrates the light transmitting component **700** in detail according to one example. Further, FIG. **6** illustrates part of the light transmitting component **700** in more details. As shown in FIG. **5**, the surface of the light transmitting component **700** is fully distributed with multiple light transmitting microstructures **730**. For fitting with each other in a compact manner, as shown in a region M of FIGS. **5-6**, each of the light transmitting microstructures **730** may be hexagon-shaped. However, in other examples, each of the plurality of light emitting microstructures **730** can be in other geometric shapes, as long as the geometric shape keeps each of the plurality of light emitting microstructures **730** in mutually-compact manner, for example, regular quadrilateral or octagonal.

Similarly, the light transmitting component **700** may include at least one engaging element **720**. And the lens may further include at least one engaging element **310**. By detachably engaging the at least one engaging element **720** to the at least one engaging element **310**, the light transmitting component **700** can be detachably engaged to the lens **300** for covering the lens **300**.

Those skilled in the art will readily observe that numerous modifications and alterations of the device and method may

be made while retaining the teachings of the invention. Accordingly, the above disclosure should be construed as limited only by the metes and bounds of the appended claims.

What is claimed is:

1. A light bulb, comprising:

a housing, having a circumferential opening and a cavity chamber therein;

an illuminating component, disposed within the cavity chamber;

a driving circuit board, disposed inside the cavity chamber, electrically coupled to the illuminating component, and configured to drive the illuminating component while being powered up;

a lens, disposed within the cavity chamber and configured to focus lights emitted by the illuminating component on a predetermined range along an axial direction of the light bulb; and

a light transmitting component, disposed at the circumferential opening of the housing to cover the lens, and the light transmitting component comprises a plurality of light transmitting microstructures on its surface that uniformly distribute the focused lights from the lens along the axial direction of the light bulb, wherein the light transmitting component further comprises a first engaging element that faces the lens;

wherein the lens further comprises a second engaging element that faces the light transmitting component; and

wherein the first engaging element is detachably engaged with the second engaging element, such that the light emitting component engages with the lens.

2. The light bulb of claim **1**, wherein the light transmitting component comprises a light guide plate.

3. The light bulb of claim **1**, wherein each of the plurality of light emitting microstructures is hexagon-shaped.

4. The light bulb of claim **1**, wherein the light transmitting component comprises a circular-shaped plate.

5. The light bulb of claim **1**, wherein the illuminating component comprises a plurality of light emitting diodes that emit at least two different color temperatures.

6. The light bulb of claim **1**, wherein the light transmitting component comprises an opal glass diffusing plate.

7. The light bulb of claim **1**, further comprising:

a bulb base, disposed within the cavity chamber for supporting the illuminating component.

8. The light bulb of claim **7**, wherein the bulb base comprises:

a circumferential base plate, disposed between the illuminating component and the driving circuit board, wherein the circumferential base plate matches the circumferential opening of the housing such that the base plate is capable of fitting the cavity chamber; and

a sidewall, coupled to the circumferential base plate and configured to surround the illuminating component;

wherein the illuminating component and the driving circuit board are disposed in opposite sides of the base plate.

9. The light bulb of claim **8**, wherein the illuminating component further comprises a power socket;

wherein the base plate further comprises a driving through hole;

wherein the driving circuit board further comprises a conductive connector, which is configured to pass through the driving through hole and reach the power socket for detachably engaging both the illuminating component and the driving circuit board to the base plate; and

wherein the driving circuit board is further configured to drive the illuminating component via an electrical connection between the conductive connector of the driving circuit board and the power socket of the illuminating component.

10. The light bulb of claim **1**, further comprising:

a screw;

wherein the illuminating component further comprises a screw through hole that allows the screw to screw through;

wherein the housing further comprises a screw hole within the cavity chamber for receiving the screw; and

wherein the screw is configured to screw through the screw through hole and to reach the screw hole for detachably engaging the illuminating component to the housing.

11. The light bulb of claim **1**, wherein the illuminating component comprises a surface mounted light emitting diode (SMD LED) module.

12. The light bulb of claim **1**, wherein the housing further comprises a socket, which is disposed at the surface of the housing, electrically coupled to the driving circuit board, and configured to power up the driving circuit board while being electrically coupled to an external power source.

13. The light bulb of claim **1**, wherein each of the plurality of light emitting microstructures is in a geometric shape that keeps each of the plurality of light emitting microstructures in mutually-compact manner.

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